

State and Fiscal Impact of State Investment in Michigan's Advanced Battery Manufacturing Industry

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Summary of Findings

Because the state stimulus piggybacks on federal stimulus expenditures, state investment in Michigan EV battery manufacturing will propel statewide economic impacts.

Conservative estimates of capital investment and the demand for Michigan-produced advanced battery packs are used in this analysis. Between 2010 and 2020, \$3 billion will be invested in capital infrastructure. Furthermore, state production of battery pack assemblies will total 1.5 million units annually by 2020 at the minimum, but will most likely reach annual production of 3 million units.

Execution of this plan will result in a minimum of 20,167 direct jobs by 2020 under the low impact scenario and 39,087 for the most-likely case.

Gross regional product will reach \$9.40 billion annually in 2020 under the lowest-likely scenario, and reach \$18.12 billion under the most-likely scenario.

A rate of return on investment calculation is not possible because state investment is deferred to start in 2012. Another measure of the fiscal return is the benefit-cost ratio that ranges from 4.90 under the most pessimistic estimate to \$8.07 under the most-likely estimate. This implies that at the very minimum, \$3.90 in tax revenue will be generated for every state dollar invested in this stimulus. However, the actual expected fiscal return is \$7.07 for every dollar.

Total output and employment multipliers are calculated based on these results. Under the low impact scenario, employment and output multipliers are 2.28 and 2.14 respectively. Under the most likely scenario, they are 2.24 and 2.08 respectively.

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Detailed Analysis

Government Incentives

From the Michigan State Government perspective, this investment piggybacks on federal stimulus in EV battery production. As opposed to many state industry incentives where state investment precedes industry development, state investment in this economic development plan is deferred to 2012.

In this analysis, state invests \$300 million total over the years 2012 to 2015 for the support and development of three advanced automotive battery manufacturing facilities. This investment represents a loss of other use of these funds for other state and local government uses. Federal investment of \$750 million is allocated over years 2010 and 2011 for capital and R&D expenditures.

Capital Investment

This analysis assumes three battery cell manufacturing plants are created with associated upstream investment. Total capital investment for all three pack manufacturing plants includes initial investment of \$1.5 billion over years 2010 and 2011. Subsequent investments in upgrades and expansion are expected to follow for years 2012 to 2020 of \$166.6 million per year. In total, \$3 billion investment in capital infrastructure is foreseen over the years 2010 to 2020. All capital investment is assumed to arise from a combination of federal and state stimulus, and private equity and debt financing.

Battery Manufacturing

EV pack assemblies are initially valued at \$10,000 per unit in 2011 and decrease by half by 2020. As production ramps up, efficiency gains across the industry will lower the cost of pack assemblies. This reduction in the cost of assemblies results in a relative decline in EV costs to combustion-powered vehicles; thereby supporting increased output of pack assemblies.

Cell battery pack production starts at a limited scale in 2011 at 20,000 units per assembly plant. This increases to 50,000 in 2012 and 100,000 in 2013. Production continues to increase in response to relative decrease in the cost of EVs beyond 2013 to 500,000 or 1,000,000 in 2020 per pack assembly plant, depending on the scenario provided below.

Michigan cell manufacturing facilities must initially rely on outside supply chains for the inputs required for cell manufacturing. Only 30 percent of the typical automobile assembly supply chain is assumed to exist in 2011 for cell production. This increases to 45 percent in 2012, 65 percent in 2013, and 90 percent in 2014. Beyond 2014, the in-state supply chain supporting battery and pack manufacturing reflects the overall Michigan automobile assembly supply chain.

Built into this analysis are several conservative assumptions. First, capital investment is spread over 12 years. This defers benefits of capital expenditures over other estimates that place completion of capital investment by year 2014. Second, this analysis only places economic impacts on the value of EV pack assemblies. Capital investment and research and development efforts are expected to accrue to other advanced cell battery uses as well (hybrid, DOD, etc.). Only EV applications are modeled in this analysis. Finally, annual pack assemblies of 1 million units by 2020 is the lower spectrum of market estimates for these proposed capital expenditures. The lowest estimate of 500,000 units per year provides the absolute floor of the expected impact.

Findings

The first analysis assumes limited EV demand of Michigan produced pack assemblies. In this is the lowest return scenario, only 1.5 million units are produced annually by the three cell manufacturing plants by 2020. This scenario estimates that total jobs in Michigan will increase by 45,920 jobs, as shown in Table 1. Manufacturing and service sector jobs are most impacted with 13,980 and 15,450 new positions respectively. Gross regional product takes gains of \$9.40 billion annually by 2020. MEGA calculations for gross tax receipts are provided¹. These values do not count direct outflows of state stimulus tied to EV battery pack assembly.

Return on investment calculations provides that the fiscal benefit-cost ratio, discounted to today², is \$4.90. That is, \$1 of state stimulus expenditures brings in \$3.90 additional tax receipts.

Table 1: Limited-Production State Impacts

Variable	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emp	0	10,900	12,380	4,942	10,570	20,330	28,620	35,620	39,820	42,920	44,940	45,920
Nat Res, Mining, Util, Const	0	6,482	6,399	1,149	1,292	1,868	2,537	3,222	3,629	3,895	4,028	4,037
Manufacturing	0	203	606	1,395	3,586	7,103	9,877	11,470	12,640	13,440	13,880	13,980
Trade	0	1,148	1,456	916	1,731	3,122	4,255	5,047	5,578	5,953	6,178	6,261
Transp, Inform, Fin Act	0	712	843	473	980	1,838	2,535	3,016	3,324	3,535	3,655	3,690
Services	0	2,221	2,817	1,813	3,670	6,847	9,558	11,620	13,060	14,180	14,980	15,450
State and Local Gov	0	135	259	-804	-689	-448	-142	1,245	1,589	1,917	2,219	2,502
Total GRP (\$Mill Nom)	0	707.9	943.0	706.3	1,645.8	3,319.1	4,862.2	6,111.5	7,151.2	8,059.2	8,814.4	9,404.5
Personal Income (\$Mill Nom)	0	516.5	664.1	397.5	788.3	1,508.0	2,197.0	2,802.0	3,287.0	3,708.0	4,055.0	4,322.0
Output (\$Mill Nom)	0	1,228.0	1,675.9	1,500.8	3,516.5	7,062.3	10,313.4	12,755.4	14,893.0	16,738.8	18,250.5	19,416.6
MEGA TAX (\$Mill Nom)	0	39.8	51.1	30.6	60.7	116.1	169.2	215.8	253.1	285.5	312.2	332.8

¹ MEGA tax calculations represent a cursory estimate of state tax impact, including sales tax, personal income tax, business tax, property tax, and other taxes, as they relate to economic activity in the state. Such estimates are based on historic relationships between state-wide economic variables and Michigan tax receipts.

² Both positive and negative cash flows are discounted to 2009 based on 7.5 percent interest that represents both the opportunity forgone of investing in alternative projects and an inflation premium.

The second scenario, while maintaining conservancy, is the mostly-likely case scenario. In this scenario, 3 million battery pack assemblies are produced annually by 2020. This scenario anticipates 87,630 new Michigan jobs by 2020 as shown in Table 2. Similar to findings provided above, manufacturing and service employment retain the largest shares. In addition, gross regional product is expected to add \$18.12 billion annually by 2020. Finally, MEGA tax calculations indicate strong tax receipt generation associated with this impact.

Fiscal impact calculations provide a benefit-cost ratio of 8.07. That is, given this most-likely scenario, \$1 stimulus will result in \$7.07 increase in state government receipts.

Table 2: Most-Likely Case State Impacts

Variable	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Emp	0	10,900	12,380	4,942	10,570	28,850	46,500	60,830	71,080	78,950	84,440	87,630
Nat Res, Mining, Util, Const	0	6,482	6,399	1,149	1,292	2,363	3,765	5,158	6,173	6,915	7,375	7,563
Manufacturing	0	203	606	1,395	3,586	10,280	16,320	20,280	23,310	25,500	26,870	27,480
Trade	0	1,148	1,456	916	1,731	4,338	6,771	8,554	9,882	10,860	11,520	11,850
Transp, Inform, Fin Act	0	712	843	473	980	2,605	4,117	5,206	5,994	6,563	6,924	7,092
Services	0	2,221	2,817	1,813	3,670	9,601	15,330	19,770	23,200	25,930	27,950	29,260
State and Local Gov	0	135	259	-804	-689	-337	197	1,862	2,521	3,182	3,801	4,385
Total GRP (\$Mill Nom)	0	707.9	943.0	706.3	1,645.8	4,714.4	7,899.2	10,559.2	12,902.1	14,978.3	16,718.6	18,123.2
Personal Income (\$Mill Nom)	0	516.5	664.1	397.5	788.3	2,098.0	3,506.0	4,753.0	5,832.0	6,786.0	7,590.0	8,224.0
Output (\$Mill Nom)	0	1,228.0	1,675.9	1,500.8	3,516.5	10,056.8	16,803.1	22,211.0	27,073.1	31,327.5	34,895.4	37,705.3
MEGA TAX (\$Mill Nom)	0	39.8	51.1	30.6	60.7	161.5	270.0	366.0	449.1	522.5	584.4	633.2